



John F. Kennedy Space Center

# Wireless Data Acquisition and Control System



The National Aeronautics and Space Administration (NASA) seeks to transfer the NASA-developed Wireless Data Acquisition and Control System technology to private industry for use in commercial applications. This system was developed at the John F. Kennedy Space Center (KSC) as a high-performance, low-cost, wireless data acquisition and control system. Employing low-power radio frequency (RF) communication links, this system was developed to meet stringent requirements for reliability, data integrity, and power consumption. Currently in operational use at KSC, NASA's data acquisition system can benefit a broad range of commercial applications.

## Technology Details

KSC's wireless data acquisition and control system consists of a central station and any number of remote stations. The central station is based on a standard PC (desktop, laptop, industrial, or

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## BENEFITS

- Sensor-level processing — Microcontroller at remote station enables real-time analysis.
- Low power requirements — Smart power management scheme allows for increased life of battery-powered remote stations while reducing size, weight, and cost.
- High reliability — System provides self-diagnosis of communications links and automatically reconfigures upon failure detection.
- Guaranteed data integrity — Buffering at remote stations ensures data availability and integrity if temporary communications losses occur.
- Scalability — Modular design facilitates any installation.
- Speed — Latency time between central station request for data and receipt of data from remote station is 10 ms.
- Low cost — Generic modules are common to remote and central stations.

technology ■ opportunity

## APPLICATIONS

- Defense — data communication links for test ranges and launch facilities
- Building automation systems — real-time monitoring and control of security and surveillance systems, alarms, HVAC, etc.
- Utilities — remote meter reading
- Manufacturing and distribution — industrial automation
- Health care — wireless monitoring equipment

## TECHNOLOGY STATUS

- Patent pending
- U.S. patent
- Copyrighted
- Available to license
- Available for no-cost transfer
- Seeking industry partner for further codevelopment

embedded) with NASA-developed Lab-VIEWTM software. The PC's RS-232 port interfaces to a communications module—the same generic RF board used by the remote stations.

The remote stations employ programmable microcontrollers that can be easily reconfigured to serve many functions, depending on the application. For example, the microcontrollers can provide data buffering, sensor excitation, signal conditioning, signal conversion, data processing, decisionmaking, and control.

By processing data at the remote stations, decisions can be made at the sensor site such that information (rather than data) can be transmitted, reducing system complexity and bandwidth requirements.

Efficient power management enables the remote stations in the KSC implementation to operate on 3.6V-19Ahr batteries for over two years. Remote stations stay in a low-power-consumption mode until contacted by the central station, or until another event triggers the power management module to power up the other modules.

A low-output-power ( $\approx 10$  mW) RF system minimizes interference with surrounding systems. Range is 300 feet with a small whip antenna and can be substantially increased using a directional antenna. Secure spread-spectrum communication is used in the 433- or 918-MHz range, with 100 frequencies available for automatic reconfiguration to circumvent interference. The wireless links currently operate at 19.2 kbps but are capable of 115 kbps.

The central station normally communicates with all remote stations directly but also has functions to accommodate poor RF signal conditions or no RF signal due to placement outside the range of the central station. Upon loss of RF signal with a station, the central station initiates a routine to determine which remote station(s) have the ability to become a relay for the lost station. The routine can operate on multiple levels to create a chain of stations and permit long-distance communication using relatively low power.

### Partnership Opportunities

NASA has applied for a U.S. patent on the new wireless data acquisition and control system and is seeking licensees of the patent. NASA has the authority to grant licenses on its domestic and foreign patents and patent applications pursuant to 35 U.S.C. 207-209. NASA has implemented this authority by means of the NASA Patent Licensing Regulations, 37 CFR § 404. All NASA licenses are individually negotiated with the prospective licensee, and each license contains terms concerning commercialization (practical application), license duration, royalties, and periodic reporting. NASA patent licenses may be exclusive, partially exclusive, or nonexclusive. If your company is interested in the new wireless data acquisition and control system, or if you desire additional information, please reference Case Number KSC-12386 and contact:

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